All Quiet on the Eastern Front?
Disruption Scenarios of
Russian Natural Gas Supply to Europe

Franziska Holz, Philipp M. Richter and Christian von Hirschhausen
Berlin, 09.10.2014
Introduction

- Security of Russian natural gas supplies is high on the agenda – once more

- Different perspectives can be taken:
  - Russia: Exports, budget
  - Ukraine: Dependency, energy efficiency
  - EU: Energy Union, political and economic sanctions

- DIW Berlin prepared a larger study on Gazprom’s role in infrastructure and gas distribution companies in East, Central and West Europe as well as disruption scenarios of Russian gas supply
1. Less Russian transits to Europe via Ukraine (Nord Stream)
2. Lower share of EU imports from Russia
4. Expanded EU LNG import capacity by 15%
5. Natural gas production boom in the USA
6. Increased Asian LNG imports (Fukushima disaster)
7. Reduced EU consumption of natural gas by 4%
Disruption Scenarios with the Global Gas Model
What is the impact of interrupted Russian natural gas exports to Europe?

• Application of Global Gas Model to simulate disruption scenarios
  • Transit disruption via the Ukraine
  • Disruption of all (represented) “Gazprom”-owned infrastructure

• Focus on global effects
  • Reaction of other suppliers
  • Competition for internationally supplied natural gas (e.g. LNG)

• Identification of infrastructure bottlenecks (at the country level)

• Both short-term and long-term effects
The Global Gas Model (GGM)

“Multi-agent economic game on an underlying transportation network”

- Partial equilibrium model of the global natural gas market
- 94 regional nodes in 74 countries
- Optimization problems of different players along the value chain
- Market power for selected trade relations
- Seasonal demand
- Endogenous investment in storage and transportation infrastructure

Representation of the natural gas market and supply chain in GGM (joint work with R. Egging)
How to interpret the model’s results

- Naturally, the GGM abstracts from some observable circumstances
- No institutional friction
  - No oil-price linkage representation
  - No long term contracts taken into account
- Assumptions on production capacities
  - Relevant for short-term production increase
  - Here: critical for Norway and the Netherlands
- No intra-country pipeline networks (bottlenecks)
- No short-term reaction (within 1 year) possible vis-à-vis capacity expansions / reverse flows
- Fuel substitution only indirectly modeled by inverse demand functions
- Disruption shock in projected world for 2015 (not exactly the same as today)
### Definition of Scenarios

<table>
<thead>
<tr>
<th>Scenario Name</th>
<th>Description</th>
</tr>
</thead>
</table>
| **Base**      | **Base Case:**  
  • Projections of natural gas production and consumption based on the NPS of the WEO 2012 (IEA, 2012) |
| **UKR Disruption** | **Ukrainian Disruption:**  
  • Interruption of Russian pipeline connection to Ukraine in 2015 (direct and via Belarus) |
| **Gazprom**  | **Disruption of Gazprom infrastructure to Europe (incl. Turkey):**  
  • Reduction of total cross-country pipeline and storage capacity in 2015 that is currently majority-owned directly and indirectly by Gazprom (exception for Belarus)  
  Affected pipelines:  
  • Nord Stream  
  • Brotherhood  
  • Yamal Europe  
  • Blue Stream  
  • South Stream  
  • OPAL  
  Affected storage facilities:  
  • Rehden in Germany  
  • Haidach in Austria  
  • Incukalns in Latvia  
  • Banatski Dvor in Serbia |
| **Long Disruption** | **Same coverage as in „Gazprom“**  
  From 2015 to 2040 |
Short-Term Disruption Scenarios in 2015 with the Global Gas Model
Differences in Consumption Levels relative to the Base Case

- Effect on EU rather small on average (-2% UKR Disruption; -10% Gazprom)
- Variation across countries
  - Most affected: Ukraine, the Baltic, Finland, Romania, Hungary & Croatia
Consumption prices relative to the *Base Case*

- Equilibrium is represented by price-quantity pairs, i.e. similar impact
- Increase of prices by more than 10% for all EU countries in *Gazprom*

Figure: Prices in 2015 relative to the Base Case, in percentages. Values for the *Gazprom* scenario are provided next to the respective bars.
EU Import Structure – Base Case vs Gazprom Scenario

Figure: EU import structure in 2015 by supplier, in bcm.

- Shift in EU import structure from Russia and the Caspian region
- Increase from Africa, the Middle East, Norway and South America
EU Supply Structure across Scenarios

- Replacement of pipeline imports by domestic production and LNG imports
- LNG imports increase by almost 50% (from MEA, SAM, and AFR)
  - Increase in global LNG supply, shift from Asia toward Europe (global balancing)
European LNG Import Terminals

- LNG terminal "Operational"
- LNG terminal "Under Construction"
- LNG terminal "Planned"

Figure: LNG imports terminals in Europe, which are “operational”, “under construction” and “planned”.

- Large EU LNG import capacities of 195 bcm
- Intra-European pipeline bottlenecks hamper efficient import balancing
LNG Imports of EU Countries vs Capacities

- LNG imports increase particularly in the UK and Italy
- Low utilization rates in several countries, especially in Spain (33%)
• Strong reduction in Russian exports due to limited export possibilities
• Small export capacities of LNG and pipeline (toward China and the Caspian region)
Long-Term Disruption with the Global Gas Model
Sizeable reduction of consumption in the long run, i.e. not all Russian gas exports can be replaced, despite higher prices

Largest effect in start year of disruption, i.e. 2015
LNG Exports to Europe over Time

- Russian exports partly replaced by LNG supplies to Europe
- North American LNG exports to Europe are economic in this situation

Figure: LNG imports to the EU by destination region, in bcm.
Russian exports are largely replaced by supplies from the Middle East and Caspian which require new pipelines to replace Ukrainian transit system.

- Additional LNG imports trigger new regasification terminals.
• Replacement of Russian supplies with exports from the Middle East and Caspian also requires new pipelines in Eastern Europe
• Spanish LNG terminals are better linked to other markets
Modeling results

• Disruption of Russian natural gas exports have
  • Severe impact on some (mainly neighboring) countries in Europe
  • Rather small average effect on EU consumption on average with up to -10% consumption reduction

• Relaxation of intra-European pipeline bottlenecks could further reduce the negative impact of disruption
  • Capacities enabling reverse flows toward Eastern Europe
  • Pipeline capacities from Spain via France and from Italy toward Central Europe for LNG imports and North African Gas

• In the medium-term, the EU and the Member States should work towards a reduced exposure to natural gas imports, involving increased efficiency, the further decarbonization of the energy system
Thank you for your attention.